

We claim:

1. A process for purifying crude caprolactam which has been obtained by
  - 5       1) converting a mixture (I) comprising 6-aminocapronitrile and water to a mixture (II) comprising caprolactam, ammonia, water, high boilers and low boilers in the presence of a catalyst, then
  - 10       2) removing ammonia from mixture (II) to obtain a mixture (III) comprising caprolactam, water, high boilers and low boilers, then
  - 15       3) completely or partly removing water from mixture (III) to obtain crude caprolactam (IV) comprising caprolactam, high boilers and low boilers,
  - 20       4) which comprises
    - a) feeding the crude caprolactam and an inorganic acid which has a boiling point above the boiling point of caprolactam under the distillation conditions of the following steps b) to h) to a first distillation apparatus C1,
    - 25       b) distilling the crude caprolactam and the inorganic acid in the first distillation apparatus C1, and removing a first substream in the bottom region and a second substream in the top region of the distillation apparatus C1,
    - 30       c) feeding the second substream from step b) to a second distillation apparatus C2,
    - 35       d) distilling the second substream from step b) in the second distillation apparatus C2, and removing a first substream in the bottom region and a second substream in the top region of the distillation apparatus C2,
    - e) feeding the first substream from step d) to a third distillation apparatus C3,
    - f) distilling the first substream from d) in the third distillation apparatus C3, and removing a first substream in the bottom region and purified caprolactam in the top region of distillation apparatus C3, and
    - g) feeding the first substream from step f) to the first distillation apparatus C1.

2. A process as claimed in claim 1, wherein mixture (I) additionally comprises an organic liquid diluent.
3. A process as claimed in claim 2, wherein the liquid diluent is removed in step 3), before, during or after the removal of water from mixture (III).
4. A process as claimed in any of claims 1 to 3, wherein low boilers are removed or high boilers are removed or low boilers and high boilers are removed between step 3) and step a).
5. A process as claimed in claim 4, wherein first low boilers and then high boilers are removed.
6. A process as claimed in claim 4 or 5, wherein 6-aminocapronitrile is removed as a low boiler.
7. A process as claimed in any of claims 1 to 6, wherein the inorganic acid used is phosphoric acid.
8. A process as claimed in any of claims 1 to 7, wherein the weight ratio of the substream removed in the top region to the substream removed in the bottom region in step f) is in the range from 0.3 and 2.0.
9. A process as claimed in any of claims 1 to 8, wherein at least a portion of the first substream obtained in step b) is mixed with the crude caprolactam according to the preamble.
10. A process as claimed in claim 9, wherein the weight ratio of the substream mixed with the crude caprolactam to crude caprolactam is in the range from 0.01 to 0.3.
11. A process as claimed in any of claims 1 to 10, wherein at least a portion of the second substream obtained in step d) is recycled in step 3) before the low boilers are removed.
12. A process as claimed in any of claims 1 to 11, wherein the bottom temperature in the distillation apparatus C1 is in the range from 120 to 200°C.
13. A process as claimed in any of claims 1 to 12, wherein the pressure in one, two or three of distillation apparatus C1, C2, C3 is at least 40 bar, measured in the top region/bottom

region.

14. A process as claimed in any of claims 1 to 13, wherein the first substream from step f) is introduced at the top of the distillation apparatus C1.